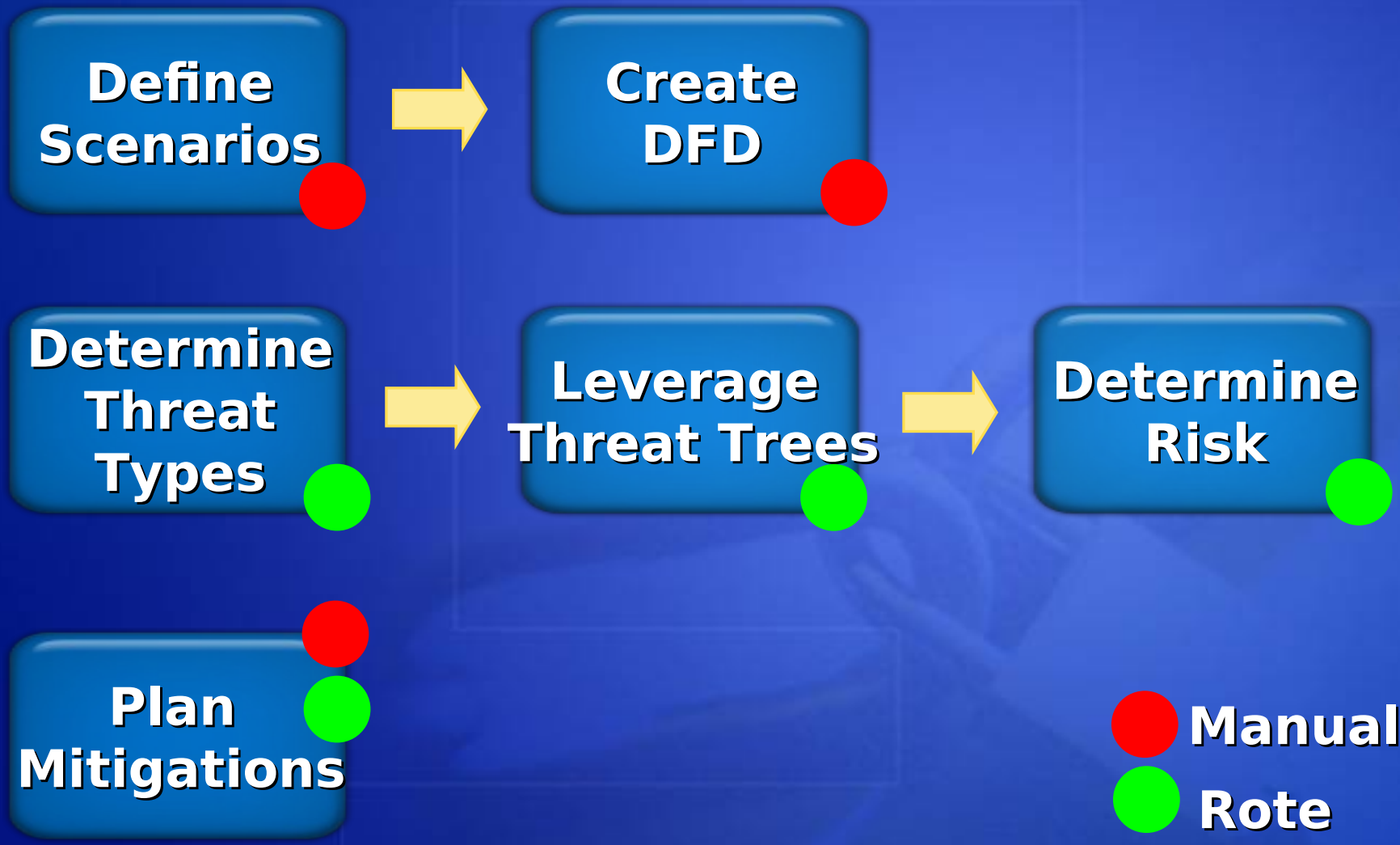
Introduction to Threat Modeling

Michael Howard, CISSP
Senior Security Program Manager
Security Engineering and Communication

Threat Analysis

- The goal of threat modeling is to:
  - Find security design flaws
  - Mitigate the threats
  - Reduce risk

The Updated Threat Modeling Process



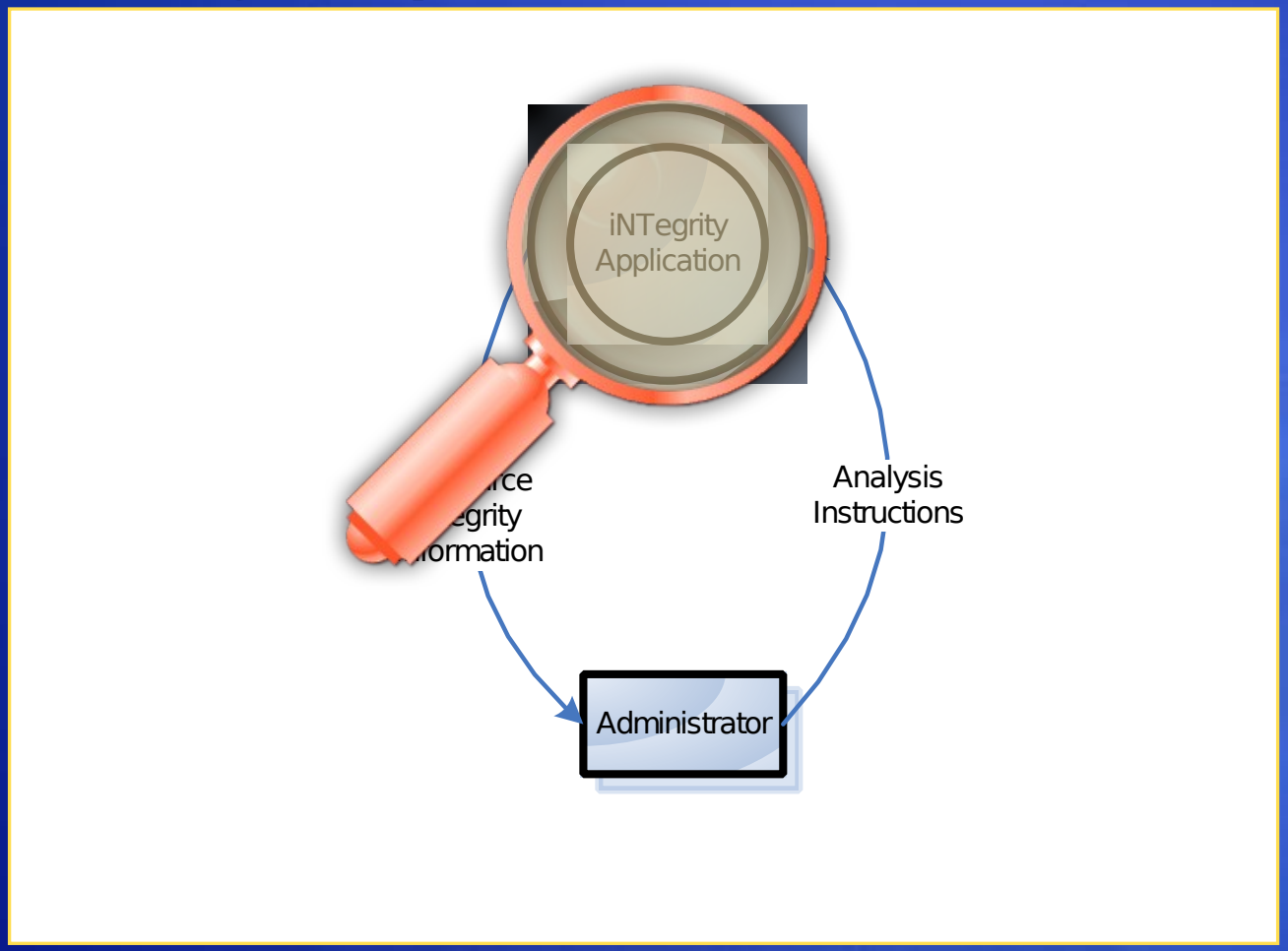
Define Scenarios & Background Info

- Define the most common and realistic use scenarios for the application
  - Example from Windows Server 2003 and Internet Explorer
    - “Admin browsing the Internet from a Domain Controller”
  - Example from Windows CE
    - “The stolen device”
- Define your users

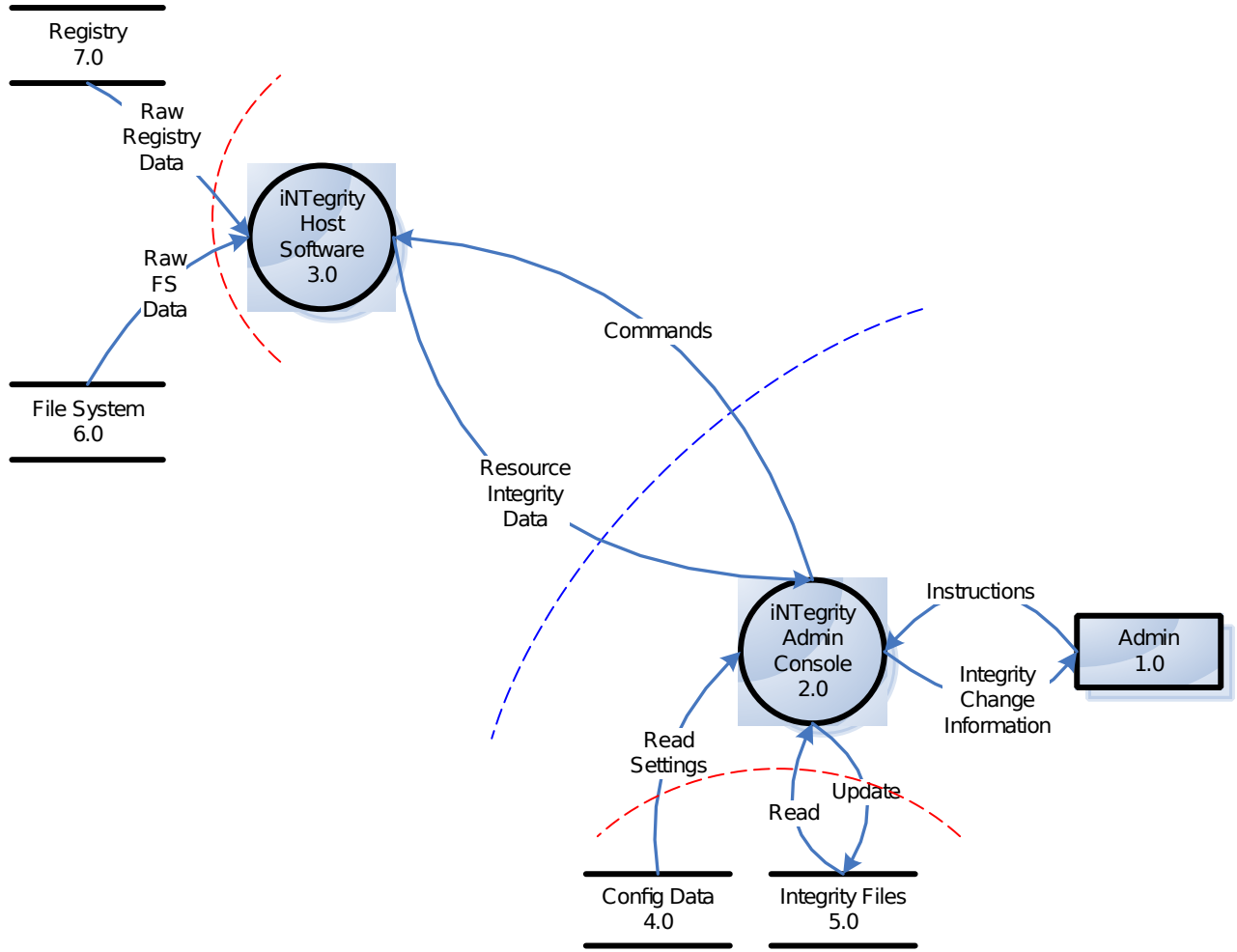
Data Flow Diagrams (DFDs)

- A DFD is a graphical representation of how data enters, leaves, and traverses your component
  - It is not a Class Diagram or Flow Chart!
  - Shows all data sources and destinations
  - Shows all relevant processes that data goes through
- Good DFDs are critical to the process
  - This point can’t be emphasised enough!
  - Building DFDs == understanding the system
  - Analysing DFDs == understanding the

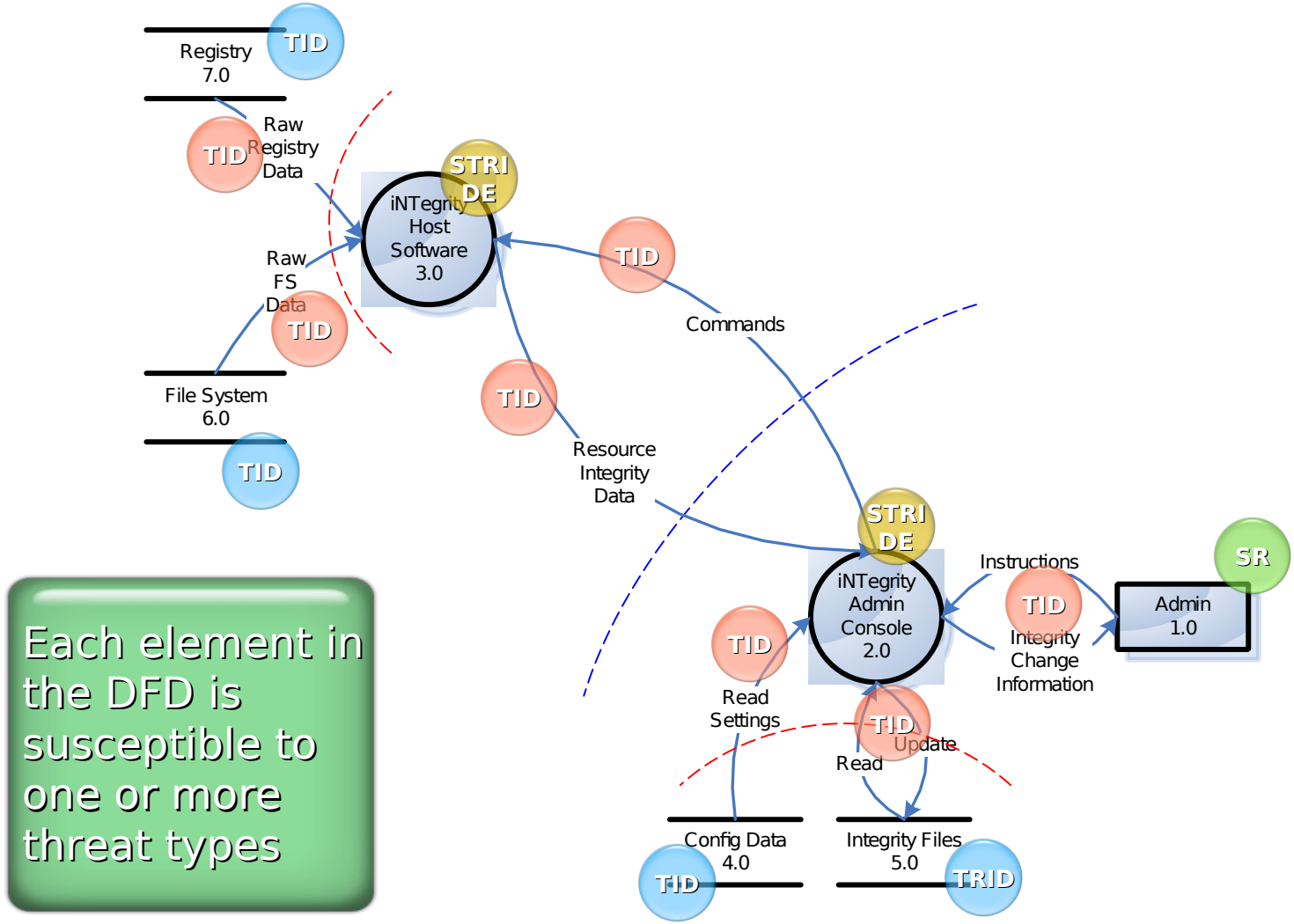
Context Diagram: An Integrity Checker



Level-0 DFD: An Integrity Checker



Level-0 DFD: An Integrity Checker



Each element in the DFD is susceptible to one or more threat types

STRIDE
A Taxonomy of Threat Types

- A more fine-grained version of CIA, but from an attacker's perspective
  - Spoofing
  - Tampering
  - Repudiation
  - Information Disclosure
  - Denial of Service
  - Elevation of Privilege

DFD Elements are Targets
A "Work list"

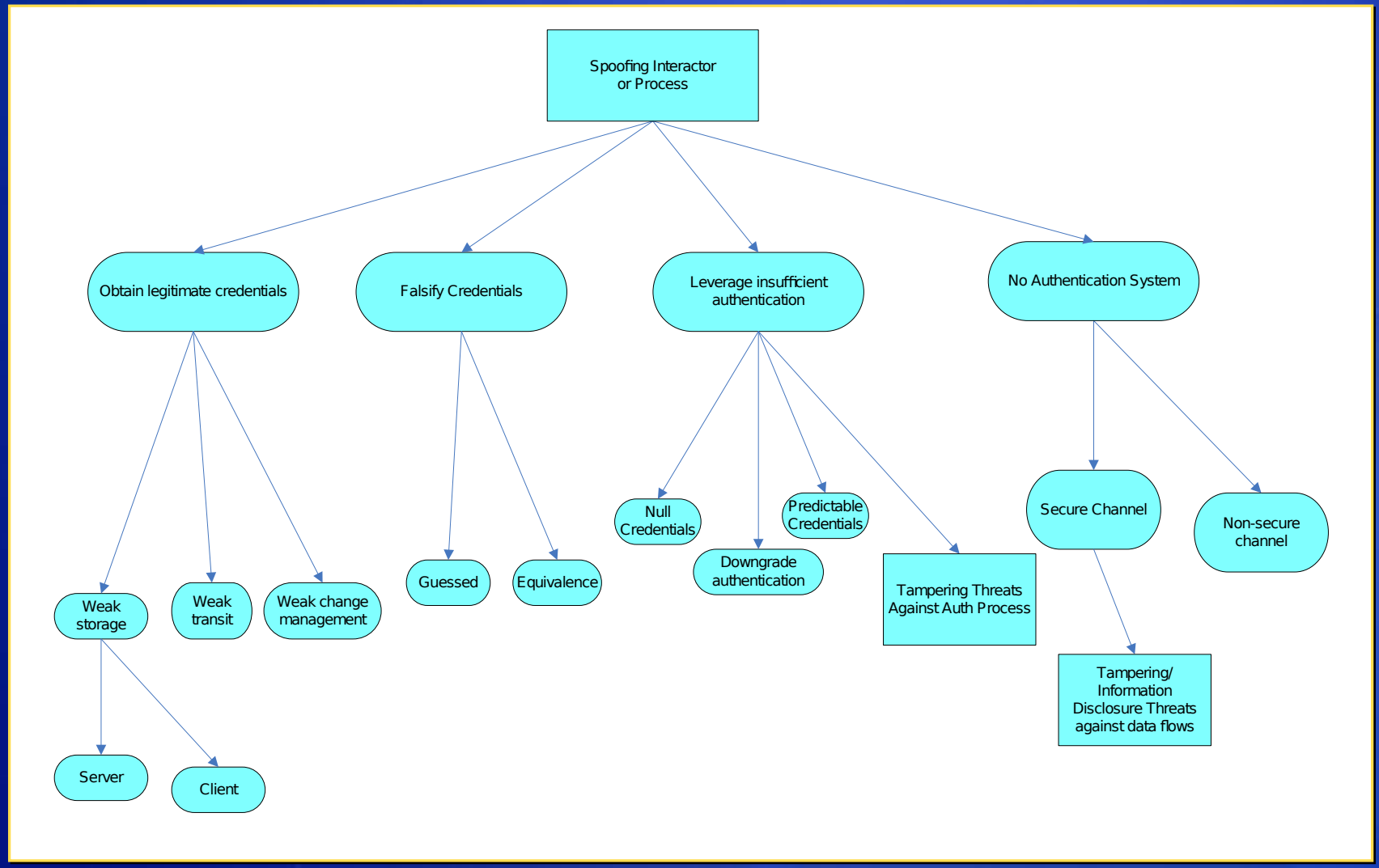
Data Flow	S	T	R	I	D	E
1→2		✓		✓	✓	
2→1		✓		✓	✓	
2→4		✓		✓	✓	
4→2		✓		✓	✓	
2→5		✓		✓	✓	
5→2		✓		✓	✓	
2→3		✓		✓	✓	
3→2		✓		✓	✓	
6→3		✓		✓	✓	
3→6		✓		✓	✓	
7→3		✓		✓	✓	
3→7		✓		✓	✓	
Data Store						
6		✓		✓	✓	
7		✓		✓	✓	
4		✓		✓	✓	
5		✓		✓	✓	
Process						
3	✓	✓	✓	✓	✓	✓
External Entity						
1	✓		✓			

Each ✓ is a potential threat to the system.

Each threat is governed by the conditions which make the threat possible

Threat Tree Pattern Examples

Spoofing



A Special Note about Information Disclosure Threats

All information disclosure threats are potential privacy issues.

Raising the Risk.

Is the data sensitive or PII?

Calculating Risk with Numbers

- DREAD etc.
- Very subjective
- Often requires the analyst be a security expert
  - On a scale of 0.0 to 1.0, just how likely is it that an attacker could access a private key?
- Where do you draw the line?
  - Do you fix everything above 0.4 risk and leave everything below as “Won’t Fix”?

Calculating Risk with Heuristics

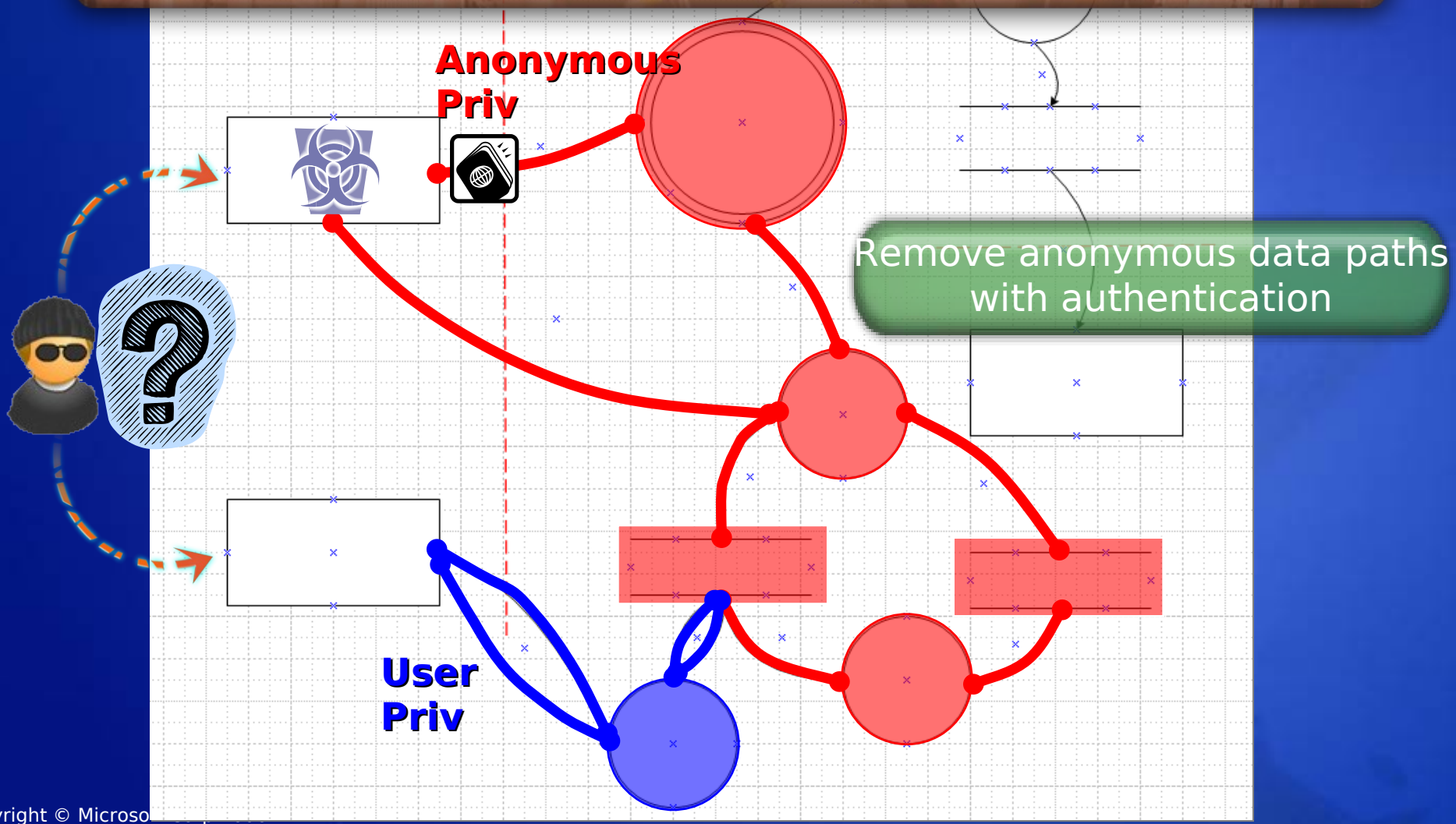
- Simple rules of thumb
- Real-world data
- Similar heuristics as the MSRC bulletin rankings

Mitigation Techniques

Threat	Mitigation Feature
Spoofing	Authentication
Tampering	Integrity
Repudiation	Nonrepudiaton
Information Disclosure	Confidentiality
Denial of Service	Availability
Elevation of Privilege	Authorization

Code Review and the DFD

Review code and data on the anonymous data flows, the threat path – this is where the bad guys go – they follow the line of least-resistance.



Testing Threats